

IMPROVING THE NUTRITIONAL STATUS OF PRESCHOOL CHILDREN BY SUPPLEMENTING ADEQUATE CALORIES

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ABSTRACT

Telah dilakukan penelitian perbaikan gizi di PT Perkebunan XI, Kebun Karet, Kabupaten Sukabumi. Anak prasekolah umur 1 – 5 tahun dibagi dalam 4 kelompok, dengan perlakuan sebagai berikut: Kelompok I adalah kelompok kontrol; Kelompok II diberi makanan tambahan kalori tinggi (C); Kelompok III diberi makanan tambahan kalori tinggi protein tinggi (CP); dan Kelompok IV diberi makanan tambahan kalori tinggi protein tinggi ditambah pendidikan gizi intensif (CPE). Setiap kelompok terdiri dari 32–35 anak. Pemberian makanan tambahan dilakukan setiap hari selama 4 bulan (122 hari). Makanan tambahan C mengandung rata-rata 500 kalori dan 4 g protein, sedangkan makanan tambahan CP mengandung rata-rata 500 kalori dan 20 g protein. Lain daripada itu pengobatan sederhana terhadap infeksi diberikan kepada setiap anak pada semua kelompok.

Konsumsi kalori sangat rendah dibandingkan dengan konsumsi protein. Dengan pemberian tambahan kalori yang cukup, tingkat keadaan gizi bertambah baik secara nyata. Perbaikan keadaan gizi pada kelompok yang diberi makanan tambahan C sama dengan pada kelompok yang diberi tambahan makanan CP dan CPE. Pengaruh pendidikan gizi terhadap perbaikan keadaan gizi belum tampak sesudah 6 bulan perlakuan. Hampir 50 % anak dijumpai menderita infeksi, dan jumlah ini menunjukkan kecenderungan berkurang selama program berlangsung.

INTRODUCTION

Malnutrition in Indonesia has an important effect on the health of the people, and Protein-Calorie Malnutrition (PCM) has long been recognized as one of the most serious deficiency problems. A national survey has found that 25 to 40 % of preschool children suffer from PCM, and among them one to three percent suffer from severe PCM, as measured by weight for height (1).

It is generally believed that this stunted growth is due to deficiencies, although it is not clear whether protein or calories or both play the major role.

To establish priorities in a food supplementation program, the minimum information required is what effective nutrients can be provided by using locally available and relatively inexpensive foods. The study presented here deals with this issue.

MATERIALS AND METHOD

The study was carried out in a Rubber Plantation in West Java, where people use rice as the staple food. The reasons why the study has been carried out in a plantation were: 1) communities are homogeneous, 2) ecological and cultural situations among sites in a plantation are similar, 3) there is a homogeneous socio-economic status, 4) each site is somewhat isolated from the other so that transmission of communicable diseases during the intervention period can be avoided and 5) data of birth of children are recorded at the plantation office. These 5 factors have been considered in relation to the evaluation of the program.

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A total of 140 preschool children of one to five years of age (5 children dropped out) was divided into 4 groups, so that each group at each site consisted of 35 children.

Group I. Control group (Co).

Group II. Received high calorie (C) supplemental food, containing on the average 500 Cals and 4 g protein for each child every day.

Group III. Received high calorie high protein (CP) supplemental food, containing on the average 500 Cals and 20 g protein for each child every day.

Group IV. Received CP supplemental food, combined with intensive nutrition education (CPE).

To avoid nutrients loss due to infection (2), in this study the children with light infections (including the control group) were cured with simple and inexpensive drugs, and all children (except the control group) were dewormed with pyrantel in adequate dosages. The children who suffered from chronic or acute infectious diseases such as tuberculosis, liver disease, kidney disease, etc., were excluded from the study. Every month a medical examination was performed on all children, and during this examination simple medical treatment was given to the children with infections.

The intervention program was carried out through the MCH Center and through the active participation of village workers and communities (3). The children were fed for a duration of 4 months, covering 122 feeding days. The time of feeding was arranged twice a day, so that the supplemental food could be eaten by the children in its whole portion and did not cut down the usual home diet. However waste portions as well as number of attendances were recorded every day.

The high calorie (C) food supplement consisted of rice flour, wheat flour, cassava, corn, sweet potatoes, ordinary sugar, brown sugar, fat and oil, coconut and other high carbohydrate foods. The high calorie high protein (CP)

food supplement consisted of rice flour, corn, wheat flour, sweet potatoes, cassava, sugar, oil, combined with high protein foods such as soybean, or its fermented products (tempe and tahu), fish, eggs and beans.

An intensive nutrition education was only given to the mothers in group IV. The subject covered breast feeding, weaning foods, feeding of young children and family, foods for expecting mothers, handling of foods, sanitation and hygiene, etc. Simple formal education was given twice a week for a period of 4 months by Nutritionists. The informal education was taught along with their participation in preparing food for their children in the Center. The mother's education involved not only discussion, demonstration and participation in practical nutrition, but elements of personal hygiene and good sanitary practices as well.

Baseline data on weights of children along with a clinical assessment were obtained before the start of the supplementary feeding, and thereafter at intervals of one week. Every month the body weight of each child was plotted on the Growth Chart. The standard of this chart is the Harvard Standard as quoted by Jelliffe (4) and adopted by the Ministry of Health Republic of Indonesia (5).

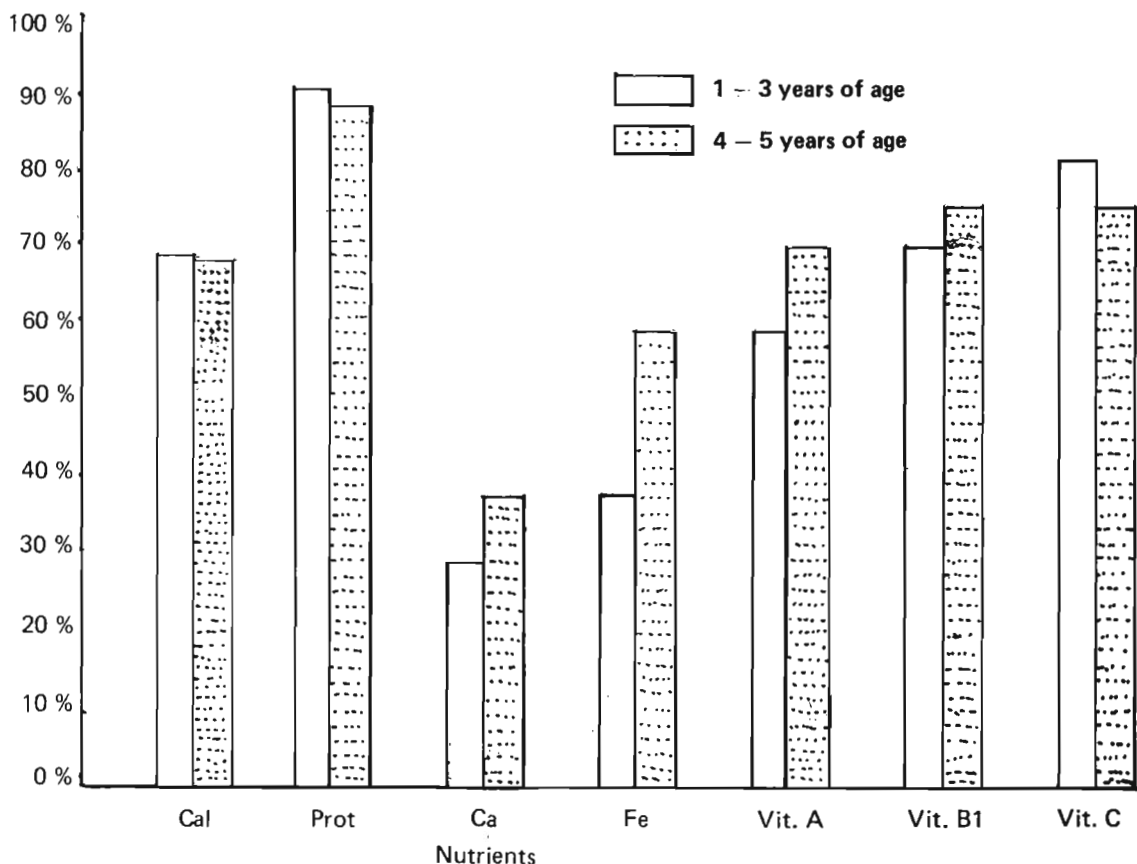
The measurement of weight was done by trained field workers with 5 years experience. The Detecto Balance was used with 0.1 kg accuracy. The medical examination was conducted by a doctor assisted by a Public Health Nurse.

Home visits to subsamples (50 % of sample), to get data on food consumption and socio-economic status, were conducted before intervention and during the last week of the period of supplementary feeding. The dietary survey was done by three Nutritionists using a modified 24 hours recall method combined with weighing method (6) (7).

Three months later, after the intervention, the weight of the children was measured again, and individually plotted on a Growth Chart. These data were then compared with the previous measurement data.

Figure 1. THE PERCENTAGE OF NUTRIENTS INTAKE TO THE INDONESIAN RDA

Percentage to RDA



RESULTS

The family income ranged from US\$ 30.- to US\$ 50.- per month.*) Housing, medical care and education were provided free of charge. The average income per person in the families was US\$ 80.- to US\$ 100.- per year. The expenses for food amounted on the average to 80 % of the income.

The average daily calorie consumption for the children from one to three years of age was 607 to 1025 Cals and 13.3 to 29.3 g protein, and that for 4 to 5 years of age was 732 to 1107 Cals and 16.9 to 31.2 g protein.

It can be seen that the daily calorie intake ranged from 66 to 67 % of RDA, while the protein intake from 92 to 93 %. The daily calorie intake was very low, but the protein intake was about at adequate level for those age group of children. The average intake of some vitamins and minerals was inadequate compared to RDA.

*) It is calculated at an exchange rate of Rp 625,- per U S\$, through the official exchange rate in 1977 was Rp 420,-/ \$. In 1978 the exchange rate changed to Rp 625,-

Table 1 shows a difference, though not significant, between the daily nutrients intake before the intervention and that at the middle of the intervention period, especially for calorie.

Thus the supplement was a real supplement and not merely a partial replacement of the home diet.

Table 1. Daily Nutrients Intake Before and During The Period of Supplementary Feeding

Age group (years)	Survey	N	Daily nutrient consumption							
			Calorie	Protein		Minerals		Vitamins		
				Animal	Total	Ca	Fe	A	B1	C
			(Cals)	g	g	mg	mg	ug	mg	mg
1 - 3	I ¹	43	816.8	6.2	20.4	126.0	3.1	254.3	0.3	15.8
	II ²	35	905.3	6.2	20.8	171.5	3.5	281.5	0.3	12.7
4 - 5	I ¹	32	953.0	7.4	25.0	169.5	5.6	277.0	0.4	14.2
	II ²	28	1051.5	7.1	25.1	171.3	4.4	277.8	0.5	17.5

¹ Before intervention

² During intervention (at the middle of intervention period), supplementary nutrients not included.

Table 2. Number of Children Suffering from Infectious Diseases Before and After Intervention

Infections ¹	Control (Co) group		Calorie (C) group		Calorie Protein (CP) group		Calorie Protein Cum Education (CPE) group	
	N = 35		N = 33		N = 32		N = 35	
	Before	After	Before	After	Before	After	Before	After
	%	%	%	%	%	%	%	%
Respiratory tract infections ²	34.3	28.6	36.4	24.2	25.0	18.8	34.3	20.0
Gastro intestinal infections ³	0.0	2.9	3.0	3.0	0.0	3.1	2.9	2.9
Skin infections ⁴	8.6	5.7	3.0	3.0	12.5	0.0	2.9	0.0
Eye infections ⁵	5.7	5.7	3.0	3.0	0.0	0.0	5.7	2.9
Others ⁶	2.9	5.7	3.0	0.0	9.4	3.1	2.9	0.0
T o t a l	51.5	48.6	48.4	33.2	46.9	25.0	48.7	25.8

¹ Worm infection was not included.

² Pharyngitis, tonsillo-pharyngitis, rhinitis, bronchitis and pneumonia.

³ Diarrhea.

⁴ Scabies, pyodermy, and folliculitis

⁵ Conjunctivitis

⁶ Varicella and morbilli.

On the average, each child in group C (calorie), CP (calorie and protein), and CPE (calorie, protein and education) consumed 83 – 93 % of the portion of supplemental food every day. If this amount is added to the food intake at their homes, the calorie intake will reach 100 % of RDA. The protein intake in group C also reached 100 % of RDA, the same as in group CP and group CPE.

The prevalence of infected children was very high. At the first medical examination (baseline data) nearly 50 % of the children in each group were found with some infection, mostly respiratory tract infection. The prevalence of this infection decreased during intervention, and according to the last examination, it was only found 33.2 %, 25.0 % and 25.8 % for Group C, Group CP and Group CPE respectively, compared with 48.6 % for the Control Group, (Table 2).

Table 3 shows the nutritional status of the children, measured before intervention, after intervention and 3 months later. The nutritional status was measured by plotting the body

weight on the Growth Chart. The child was classified as wellnourished if weight for age was above 80 % of Harvard standard, as suffering from mild and moderate PCM if between 60 – 80 %, and severe PCM if below 60 %.

The Control Group doesn't show an increase in the number of wellnourished children in contrast with Group C, which increased by 15.1 %, Group CP by 18.7 % and Group CPE by 20.0 %. Three months later, this better condition could be maintained for all treated groups (Table 3).

DISCUSSION

The outcome of the dietary survey among preschool children in this study compared with that of previous surveys can be seen in Table 4.

Calories are the most deficient in the diet of the group of children of 1 – 3 years of age and 4 – 5 years of age. The protein consumed is almost adequate. This study has found that supplement of adequate calories could increase the

Table 3. The Distribution of The Nutritional Status of The Children, Before and After Intervention and 3 Months Later.

Grouping	N	Wellnourished			Mild and moderate PCM			Severa PCM		
		B ⁴	A ⁵	R ⁶	B ⁴	A ⁵	R ⁶	B ⁴	A ⁵	R ⁶
		%	%	%	%	%	%	%	%	%
Control	35	48.6	40.0	45.7	48.6	57.1	51.4	2.9	2.9	2.9
C ¹	33	27.3	42.4	51.5	72.7	54.5	48.5	—	—	—
CP ²	32	46.9	65.5	62.5	53.1	34.4	37.5	—	—	—
CPE ³	35	48.6	68.6	68.6	51.4	31.4	31.4	—	—	—

¹ Received calories supplementation.

² Received calories and protein supplementation

³ Received calories and protein supplementation and nutrition education at that

⁴ Before intervention

⁵ After intervention

⁶ Repeated measurement, 3 months later

Table 4. Daily Calorie and Protein Consumption of Preschool Children in Some Areas in Java.

Standard/Location	1-3 years of age group			4-5 years of age group			References
	N	Calories	Protein	N	Calories	Protein	
Standard		1160	22.0		1450	27.0	Workshop on Food and Nutrition, 1978 (8)
Cilibende, Bogor	26	725	19.0	18	1183	30.0	Dradjat D. Prawiranegara, et al., 1972 (13)
Kedungbadak, Bogor	42	736	16.0	38	1218	38.0	Bernardo, et al., 1972 (14)
East Java	546	712	17.8	430	845	22.1	Sri Kardjati, et al., 1978 (15)
Rubber Plantation, Sukabumi	43	817	20.4	32	953	25.0	(This study)

number of wellnourished children by 15.1 %, of high calorie high protein by 18.7 % and of high calorie high protein cum nutrition education by 20.0 %. It is therefore obvious, that in rice eating areas the supplementation with adequate calories should become the first priority. The cost for calories is much lower than that for protein. The C food supplement costed Rp 25.- (US\$ 0.04) and the CP one Rp 35.- (US\$ 0.06) per child per day, including the fuel.

It must be emphasized however, that the supplemental calorie should not be empty calories, but calories from the diversified kinds of locally available foods. By this way of intervention, the food intake can be raised to meet the caloric requirement, and concurrently the protein need might be met also. According to Gopalan (9), there is no situation in a diet in which the child is adequate with regard to calories and deficient with regard to protein alone.

The diet in this supplementation provided 400 - 500 Cals. It is based on the calculation that each child could consume 90 % of 450 - 600 Cals of the available portion. The time of feeding was arranged twice a day, and so each

portion consisted of 200 - 250 Cals. This portion was not very bulky and it was confirmed that it did not disturb the children's consumption of their usual home diet. However, this kind of supplementation can only be given to wellnourished children and mildly or moderately malnourished children. It is not suitable for severely malnourished children, because marasmus and kwashiorkor need more comprehensive treatment, with a special diet and hospitalization (10).

The relationship between infection and malnutrition is synergic. Infection worsens the nutritional status of children (11). The intervention should be aimed at both sides, cure the infection and provide food supplementation. Around 50 % of the children in this study were found with mild infections. If these infections were not cured, the food supplement could not be eaten properly. The children lost their appetite, and they would not eat food served at the center and even at their homes. In this study, simple medical treatment was given to the children in all groups who suffered from infectious diseases.

Education in nutrition, as in health, means education to adopt better practices (11) (12).

Group CPE who received high calorie high protein supplemental food combined with nutrition education did not show any superiority in increasing the number of children becoming wellnourished. The increasing weight was likely caused by the food supplementation. The education itself might effect the nutritional status after a longer period. In the future, the repetition of measurements after 6 months or one year or longer is recommended. It is to be noted, that the mothers in Group CPE, who got nutrition education, showed a different attitude to food compared with the mothers from other groups. They tended to be more active, eager to know about nutrition, showed more responsibility in participating in the center, engaged in more hygiene and sanitation practices, and enjoyed discussions.

The main purpose served by a Growth Chart is to promote healthy growth and development. However the chart can also be used to monitor growth and to interpret data in terms of nutritional status. This study has proved the usefulness of the chart for showing the effectiveness of food supplementation to an individual child or to a group of children.

SUMMARY

A study of improving the nutritional status of children between the ages of one and 5 years has been carried out in a Rubber Plantation in West Java. The subjects were divided into 4 groups (one group for each site) consisting of 32 - 35 children in each site. Group I was a control group; Group II received daily calorie supplementation (C) which provided on an average 500 Cals and 4 g protein; Group III received daily calorie and protein supplementation (CP) providing on an average 500 Cals and 20 g protein; and Group IV received CP plus nutrition education (CPE).

The supplementary feedings were provided for a period of 4 months, covering 122 feeding days. Each of the children in all groups also received simple treatment for eventual infection. The intensive nutrition education was given only to mothers of a CPE group twice a week in the class room and during feeding times, both formal and informal.

The data of the dietary survey show that the primary deficit of the dietary intake of preschool children is in calories and not in protein. The nutritional status of the children could be effectively improved by supplementation of food, which provided adequate calories. The improvement of this group was similar to the groups which received a food supplement of high calorie and protein (CP). There was no difference in the degrees of nutritional improvement between Group CP and Group CPE.

The use of a Growth Chart is very practical to assess and monitor the progress of the nutritional status of the preschool children. Nearly 50 % of the children with infection were observed during clinical examinations and the number decreased gradually during the program.

The results of the dietary experiment described above show, that for preschool children an adequate diet is needed, particularly one with additional calories, at a cost within reach of the people, which suggests the use of a composition made of locally available foodstuffs. The control of infectious diseases is also required.

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